

Automated Ply Inspection (API) for AFP, Phase I

Completed Technology Project (2014 - 2014)



Project Introduction

The Automated Ply Inspection (API) system autonomously inspects layups created by high speed automated fiber placement (AFP) machines. API comprises a high accuracy line scanner to measure surface topology of as-made layups driven by a precision articulated arm Robot to perform rapid surface scanning of a Layup after tape placement and layup. Key to API is efficient and robust software to read very large volumes of line scan data and analyze, classify and detect key Layup features very rapidly and reliably. The software retains only key features, filtering the raw data by two orders of magnitude to facilitate real-time data processing at high scan rates. Software also compares the location of as-made features (gaps, overlaps, drops and adds) with the NC program ("virtual layup") to identify and record only those as-made features that are out of tolerance. API addresses many of NASA's objectives for this topic: ? Manufacturing for launch vehicles ? Innovative automated process (AFP) ? Applies to reliable, large scale PMC structure ? Applies to Autoclave and OOA AFP methods API provides a powerful capability to enhance reliability of structures manufactured by AFP by automating a tedious and difficult manual task. In fact, the speed of AFP machines today has advanced such that manual inspection now takes as much time, and often more, than automated layup requires. API can significantly increase total AFP productivity (C-rate) and reduce cost by reducing Inspection time. Flightware has enlisted the participation of two other small businesses in this program to contribute their experience and expertise as subcontractors for specific tasks. Furthermore we have attracted the interest of larger industry leaders who supply AFP equipment and manufacture AFP Aerospace parts in this program, because they recognize its potential value. This API program is a manufacturing innovation subject to Executive Order 13329 "Encouraging Innovation in Manufacturing."



Automated Ply Inspection (API)
for AFP Project Image

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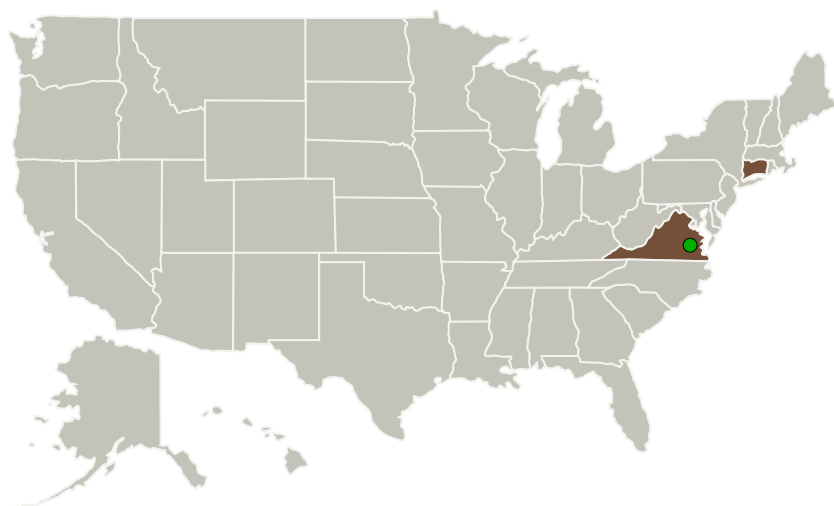
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Primary U.S. Work Locations and Key Partners



Organizations Performing Work	Role	Type	Location
Flightware, Inc.	Lead Organization	Industry	Guilford, Connecticut
● Langley Research Center(LaRC)	Supporting Organization	NASA Center	Hampton, Virginia

Primary U.S. Work Locations	
Connecticut	Virginia

Project Transitions

▶ **June 2014:** Project Start

✓ **December 2014:** Closed out

Closeout Documentation:

- Final Summary Chart(<https://techport.nasa.gov/file/137699>)

Organizational Responsibility

Responsible Mission Directorate:

Space Technology Mission Directorate (STMD)

Lead Organization:

Flightware, Inc.

Responsible Program:

Small Business Innovation Research/Small Business Tech Transfer

Project Management

Program Director:

Jason L Kessler

Program Manager:

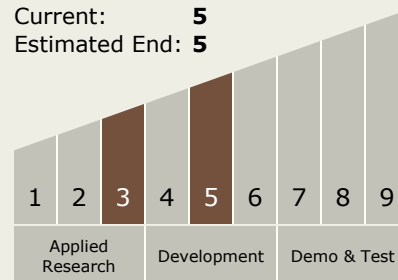
Carlos Torrez

Principal Investigator:

David Maass

Technology Maturity (TRL)

Start: **3**
 Current: **5**
 Estimated End: **5**



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Images



Project Image

Automated Ply Inspection (API) for
AFP Project Image
(<https://techport.nasa.gov/image/131320>)

Technology Areas

Primary:

- TX12 Materials, Structures, Mechanical Systems, and Manufacturing
 - └ TX12.4 Manufacturing
 - └ TX12.4.1 Manufacturing Processes

Target Destinations

The Sun, Earth, The Moon, Mars, Others Inside the Solar System, Outside the Solar System